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GEOGRAPHICAL RECORD.

THE VOLCANIC ERUPTIONS.

MARTINIQUE.—While the permanent records of the recent volcanic outbursts in the West Indies can be written only after the termination of the present period of violence gives an opportunity for thorough investigation, a preliminary statement of these occurrences will not be without present value. The statements given here are condensed from those reports in the newspaper press that have been verified, from brief interviews with Professor Robert T. Hill, of the United States Geological Survey; Dr. Thomas A. Jaggar, of the Geological Department of Harvard University; and Professor Angelo Heilprin, of Philadelphia; and from communications that have appeared in *Science* and *Nature*.

On April 18th last, severe earthquake shocks in Guatemala killed many persons and destroyed a large amount of property. The earthquake waves emanating from this region were recorded by seismographs at Baltimore, over 1,700 miles from the scene of disturbance, the Island of Martinique being about the same distance from Guatemala. The earth-billows were also recorded at Toronto, Victoria, B. C., and other distant places, showing that, whether or not the Guatemala earthquakes had any influence in precipitating the subterranean disturbances in the West Indies, the earth tremors doubtless extended beneath the Caribbean Sea floor, as well as to other regions more distant from the place of origin of the shocks.

La Montagne* Pelée, the highest of the "400 mountains of Martinique," is a volcanic cone rising 4,420 feet above the sea. It stands in the centre of the north end of the island, about five miles from the north coast, and the same distance from the port of St. Pierre on the northwest coast. The drainage from the southern slopes of the mountain reaches the sea through St. Pierre, or through the coastal plain a little to the north of it. The mountain is what is called a tuff cone, made up of volcanic dust and other fragmental rocks ejected during former eruptions. In type, therefore, the volcano differs from those in Hawaii, for example, which were built up by lava flows, and also from Vesuvius, which is composed of a mixture of lava and fragmental rocks. Within historic

* If the *Montagne* is to be turned into *Mont* in English reports, respect for grammar demands that *Pelée* be printed *Pelé*.—(ED. BULLETIN.)

times Mont Pelé has shown little activity. It rained dust over St. Pierre in 1851, the ejectamenta coming from La Soufrière crater on the slope of the mountain. The crater at the top was occupied by a small lake. There is no record that this crater has been active since the discovery of the island until the great outburst of May last. St. Pierre, however, was not destroyed by outpourings from the top of the mountain, but from a new crater on the southern slope. At rare intervals the people were somewhat alarmed by roarings accompanying the emission of steam.

The first signs of disturbance, this year, were in the last days of April, when steam was observed on the mountain and rumbling sounds were heard. The people of St. Pierre, however, were not seriously disquieted till May 3, when dense masses of steam arose above Mont Pelé, and the sky was darkened and the mountain hidden from view by steam clouds and dust. This phenomenon continued on May 4, scoria and dust sifting over the city to a depth of one-quarter of an inch.

On May 5 an immense volume of hot mud and water, issuing from a crater on the south slope, poured down the southwest side of the mountain, to a depth, it is said, of twenty feet. It followed the bed of the River Blanche, whose waters had been discoloured for several days by outpourings from the mountain. Plantations, buildings, and people were overwhelmed. In about three minutes the avalanche reached the sea, burying out of sight the Guerin sugar factory at the mouth of the River Blanche, about a mile northwest of St. Pierre. The number of persons killed at the factory was twenty-three, but the total number of victims is not known.

Meanwhile the mayor of the city and the daily newspaper *Les Colonies* were constantly assuring the people that there was no danger. A committee of investigation reported that the eruptions were normal and portended no menace to the city. M. Laudes, "the distinguished professor of the Lyceum," in an interview printed in *Les Colonies*, advised that residents remove from valleys on the lower mountain slope to avoid possible submergence by "muddy lava." He added that "Mont Pelé offers no more danger to the inhabitants of St. Pierre than Vesuvius offers to those of Naples." The people were intensely anxious, but a panic was averted by reiterations, till the very hour of destruction, that St. Pierre was in no danger. About 300 persons saved their lives by leaving St. Pierre before May 8. The exodus was characterized by the local newspaper as "mad and foolish."

On Thursday, May 8, at 8 o'clock in the morning, St. Pierre, with its population estimated at from 26,000 to 30,000 souls, was entirely destroyed by a terrific outburst from Mont Pelé. Only one person, a negress, was found alive, and she died soon after being removed from the basement in which her sufferings had been prolonged. Eighteen vessels, besides small coasting craft, were riding at anchor in the roadstead. All were destroyed except one, which succeeded in reaching the open sea, with most of its crew badly burned. A few sailors who had jumped overboard from burning vessels were saved late on the day of the catastrophe.

The city was involved in almost impenetrable darkness throughout that day. It is believed to have been practically reduced to ruins within ten to fifteen minutes after the blast from the mountain struck it, though combustible material was burning for two or three days. All animal life was probably extinguished within a very few minutes.

The destruction of St. Pierre was due to a new crater on the south side of the mountain, about half-way between the top and the city; in other words, only about three miles from the northern end of the town. The examination of the ruins shows that the superheated blast of steam, dust, stones, and gases projected upon the city must have been propelled with an energy equal to that of the most terrific tornado. Walls three feet thick were carried across streets and added to the ruins on the other side. A great many of the house walls were very thick, but nearly all that were not overturned on May 8 were destroyed in the second great eruption on May 20. The guns in a battery on a hill south of St. Pierre were dismounted and carried for rods. Heaps of volcanic dust were piled up against the north side of every ruined wall. Fire destroyed everything combustible except some of the tree trunks, though, curiously enough, the bodies of some of the victims, with their clothing, were only partly burned.

Dr. Jaggar is of the opinion that St. Pierre was destroyed by an explosive volcanic tornado. There was no lava flow; no molten matter poured from the lip of the new crater, but volcanic dust was everywhere. Professor Kemp, of Columbia University, commenting upon the preliminary statements made by observers sent to the island by the National Geographic Society and other bodies, said:

What was expelled was dust mixed with steam and speedily turned into mud, finely-broken rock and gases of a highly-inflammable sort. The tremendous force of the outburst from some point beneath the surface carried with it immense quantities of the material of which the cone was composed, scattering it to great distances.

The lightnings and detonations are regarded by some of the observers as the result of the union—with explosive force—of gases with oxygen, a phenomenon that is believed to have hastened the ruin of the city and the extinction of animal life. Enormous quantities of hot black mud were also poured out of the new crater, a great deal of the destruction in the northern part of the city being due to these avalanches.

According to Professor Hill, the zone of complete destruction is in the form of an elongated oval extending partly over the sea and embracing eight square miles of land surface. As both the crater at the peak and the new crater on the slope were in eruption, the zone of total destruction on land extends from the top of the mountain to the coast at Le Prêcheur in the north and to Carbet in the south, a distance of between six and seven miles. Counting from south to north, St. Pierre occupied the second mile of this devastated coast line. All vegetable and animal life was annihilated in the area between this part of the coast and the top of the mountain. In a zone outside this region vegetation was badly injured, but not wholly destroyed; still farther away dust and stones fell, but no injury was done. Hundreds of fumaroles, or miniature volcanoes, opened new areas of active vulcanism on the south slope of the mountain. The most conspicuous ejectamenta from the new crater during the remainder of May were large volumes of black hot mud, which poured down the valleys and into the sea. The old crater at the top ejected steam, mud, pumice, and lapilli (scoriaeous fragments about a half-inch in diameter), but no lava. The salient topography of the region has not been altered.

Violent eruptions of Mont Pelé occurred on May 20, 26, 28, and on later days. It is believed that the period of large activity may continue for some time. The eruption of May 20, exactly similar to that of May 8 and probably of equal violence, completed the destruction of the walls of St. Pierre and covered much of the island with dust. A heavy pall of dust clouds hung over Fort de France, the capital of the island, about fourteen miles from the top of Mont Pelé; many small stones fell at Fort de France both on May 8 and May 20.

LA SOUFRIÈRE.—If it had not been for the awful destruction of life at St. Pierre on May 8 the great catastrophe which occurred on the little island of St. Vincent, about twenty-four hours earlier, would have fixed the attention of the world upon that spot. La Soufrière, the volcano at the northern extremity of St. Vincent,

about ninety miles south of Mont Pelé, had been quiescent since 1812, when a tremendous eruption destroyed the east end of the island and buried St. Vincent under a thick layer of volcanic dust. Several weeks before the eruption of May 7 last rumblings and slight earthquakes had given warning of disquietude; on May 6 there was a severe earthquake, and steam and dust were violently ejected from the crater. On the following day eruptions of extreme violence occurred and about 1,700 persons were killed, mostly on the eastern or windward side of the island, by avalanches of hot mud and the explosive and deadly gases that accompanied the outbursts. A number of villages were buried under mud, and life was destroyed in a large part of the northern third of the island. The loss of life would have been much greater if many of the people had not fled to the south before the great catastrophe came.

On the island of St. Lucia, which lies midway between these two areas of volcanic activity, the boiling sulphur springs and volcanoes remain in their normal condition. The dust clouds from La Soufrière are said to have been driven to a height of eight miles, much of the dust getting into the eastward-moving current of the upper air, where it was carried 100 miles east to Barbados and scattered over that island to a depth of several inches. The detonations in St. Vincent and Martinique were heard as far away as Barbados.

ERUPTIONS IN ALASKA.—Some degree of activity is reported, this season, along the eastern part of the volcanic belt which extends through the Aleutian chain and Cook Inlet to Mount Wrangell. The volcanoes said to have been in eruption extend from Augustine Island, at the entrance to Cook Inlet, to Mount Blackburn, thirty miles southeast of Mount Wrangell, a distance of about 200 miles. Mr. Spencer, of the Geological Survey, who visited Blackburn in 1900, expresses doubt of the accuracy of the report that it has become an active volcano. He says it is composed of limestones, shales, and various igneous rocks, and he did not think, when he saw it, that it could properly be classed even as an extinct volcano. Mount Redoubt, also reported to be active, lies to the west of Cook Inlet, and is nearer to the well-known Iliamna on that inlet than to any other active volcano.

POPULAR ACCOUNTS OF THE ERUPTIONS.—Certain words and phrases used in the newspaper reports of the eruptions, some of which were excellent, might better have been avoided, as they were likely to convey a wrong impression. It is well not to apply the

word "ashes" to the ejectamenta of a volcano, as the idea may be imparted that the so-called ashes are the residue of combustion, while in fact they consist of the finer particles of the ejected matter, and may, more properly, be called volcanic dust. The word "smoke" is often wrongly applied to the steam, whose apparent blackness is due to the vast quantities of dust or stones that are shot out of the crater with it. Some reports also spoke of flames shooting up from the crater of Mont Pelé. This may have been correct as applied in the description of these eruptions. Professor Russell says, in his *Volcanoes of North America*, that Fouqué, at the eruption of Santorin, in 1866, first established the existence of true volcanic flames, due principally to the combustion of free hydrogen. Sulphuretted hydrogen may also be emitted, and, being inflammable, sometimes burns with a bluish flame. Professor Russell adds that, except in these cases of combustion, very little actual burning accompanies volcanic eruptions, and it is of minor importance as a part of the spectacle witnessed. When we read of flames pouring out of craters, the cause of the phenomenon, in many cases, is the reflection on the steam clouds above the crater of the molten lava beneath.

EUROPE.

RUSSIAN EMIGRATION TO SIBERIA.—Much attention has been attracted, in recent years, to the very large movement of Russian peasants to new homes in Siberia. In 1900 the number of emigrants reached the enormous total of 219,263 persons. These peasants, living in their villages in Russia, are impressed with the idea that they would be more prosperous on the wide and fertile lands which are open for settlement in Siberia. The difficulties of emigration have been largely removed by the Trans-Siberian railroad, which has reduced to days a journey that would formerly have required months. The cost of the journey is very small. An adult pays a fare of only four roubles between Moscow and Omsk, a distance of 1,800 miles. Children under ten years of age are carried free. The rates on baggage are also insignificant. On the other hand, the freight rates on live animals are comparatively high. The price for transporting a horse is three times the cost of an emigrant's ticket. The emigrant, therefore, sells his horse in Russia, and with the money he can buy three, and sometimes four, horses in Siberia.

Most of this emigration is from the fertile black earth region in central Russia, the largest numbers going, in 1900, from the Governments of Poltava (33,631), Kursk (19,903), Chernigov (16,585),

Mohilev (16,358), Kharkov (15,438), Vitebsk (11,876), and Voronezh (10,810).

Thus it is not the largest or the least fertile provinces that supply the most emigrants. The movement comes from all the European portions of the empire, excepting Finland and Poland; but it is smallest in the provinces that are nearest to St. Petersburg and Moscow, those great cities having more attractions than far-off Siberia for the neighbouring peasantry who may desire to leave their villages. Considerably more than half of the emigrants are males.

The emigrants scatter through Siberia from the Urals to the Pacific; but the fertile lands of West Siberia, particularly in the Government of Tomsk and Akmolinsk, and the neighbouring lands of Yenisei Government, in east Siberia, are especially attractive to them. More than half of them in 1900 settled in these three provinces. In the Tomsk Government, where over 75,000 emigrants settled in that year, a large area of excellent land, known as the "Lands of the Imperial Cabinet," is now open to the newcomers.

The first work before the emigrants is to erect their habitations, begin cattle-raising, and plough their new lands. It is found that if the colonists harvest two or three good crops they seem content to remain as permanent settlers; but if their new life begins with a bad season, like that of 1901, when drought destroyed their crops, they are likely to return to Europe.—(*Ann. de Géog.*, 1902, No. 56, pp. 173-77.)

ASIA.

THE MAMMOTH IN SIBERIA.—*Petermanns Mittheilungen* (1902, p. 47) reports the arrival at Sredne Kolymsk on October 28 last of the expedition sent out by the Imperial Russian Academy to bring to St. Petersburg the remains of the mammoth found not far from that place by the Cossack Yawlowski. The party had found the remains and brought them to Sredne Kolymsk, which is on the Kolyma river, east of the Lena. Since its discovery the body had not been properly protected, and wild animals had eaten much of the flesh; but few of the bones were missing, and enough of the thick hairy covering and the hide were recovered to give an accurate idea of the appearance of the animal. The remains of food were found between the teeth, on the tongue, and in the stomach. It is probable that, while feeding, the animal slipped into an ice crevasse, where its body became covered with a mass of sand and clay, and was permanently preserved by freezing.

Dr. R. Pohle, in February, spoke before the Geographical Union

of Dresden on the question whether the numerous mammoths that had been found had lived in north Siberia, where their remains have been discovered, or whether their bodies were carried there by floods in the rivers (*Verhandlungen* of the Berlin Geog. Soc., 1901, Nos. 8 and 9). He said that all the evidence of the last century showed that they had lived where their remains were found. A sub-cutaneous layer of fat and a thick wool-covering adapted them for a cool climate; and during their geological epoch conifers, birch, alders, and willows grew to the shores of the ice sea and on the New Siberian Islands, the animals feeding on their leaves and branches. They were gradually destroyed by the increasing cold, which drove the tree boundary southward.

ECONOMIC GEOGRAPHY.

DISTRIBUTION OF THE MANUFACTURING INDUSTRIES OF THE UNITED STATES.—This table is compiled from the Census *Bulletin* on Manufactures in the United States. It shows the gross value in million dollars of the products of the manufacturing industries of the United States, in 1900, by States and Territories, arranged in the order of their productivity:

1. New York, 2,175.	19. Nebraska, 144.	36. Oregon, 46.
2. Pennsylvania, 1,835.	20. Virginia, 133.	37. Delaware, 45.3.
3. Illinois, 1,266.	21. Maine, 127.	38. Arkansas, 45.2.
4. Massachusetts, 1,035.	22. Louisiana, 121.	39. Mississippi, 40.
5. Ohio, 832.	23. Texas, 119.	40. Florida, 37.
6. New Jersey, 611.	24. New Hampshire, 118.6.	41. Hawaii, 25.
7. Missouri, 385.	25. Tennessee, 107.	42. Arizona, 21.3.
8. Indiana, 378.	26. Georgia, 106.6.	43. Utah, 21.2.
9. Wisconsin, 361.	27. Colorado, 103.	44. South Dakota, 12.
10. Michigan, 357.	28. North Carolina, 95.	45. North Dakota, 9.
11. Connecticut, 353.	29. Washington, 87.	46. Oklahoma, 7.
12. California, 303.	30. Alabama, 81.	47. New Mexico, 5.6.
13. Minnesota, 263.	31. West Virginia, 75.	48. Wyoming, 4.3.
14. Maryland, 243.	32. South Carolina, 59.	49. Alaska, 4.2.
15. Rhode Island, 184.	33. Vermont, 58.	50. Idaho, 4.
16. Kansas, 172.	34. Montana, 57.	51. Indian Ter., 3.8.
17. Iowa, 165.	35. District of Columbia, 48.	52. Nevada, 1.6.
18. Kentucky, 155.		

COTTON-GROWING IN TOGO.—In 1900 the German Colonial Industrial Committee secured the services of some young negro farmers from Booker Washington's school to go to Togo, the German colony on the Gulf of Guinea, West Africa, to experiment with cotton-growing. It was hoped, if the results were promising, to make cotton culture one of the native industries, and provide Ger-

many with a colonial source of cotton supply. The results of the experiment thus far are published in No. 2 of the Committee's *Beihefte zum Tropenpflanzer* (1902). The experiment has been carried out at seven places in Togo with gratifying results. Soil and climate are alike favourable to the growth of cotton, and the natives readily understand the American method of cultivating it.

The area adapted for cotton culture is about 500,000 hectares in extent, or larger than the entire cotton-growing region of Egypt. The first shipment, about 8,400 pounds of lint cotton, reached Bremen on February 5 last, where it was graded as a little superior to American middling. The Committee believes that a gradual but steady development of the industry among the natives may be expected, and that the prospects will be improved when the railroad between the port of Lome and the interior, now building, affords cheaper transportation (*Globus*, 1902, April 24).